

# SINGLE FORCE STRUT FOR DUAL SIDED CARGO BOX

## DESCRIPTION

### Cross-Reference To Related Applications:

[Para 1] The present patent application claims the benefit of U.S. Provisional Application No. 60/481,491 filed 09 October 2003. Said application is expressly incorporated herein by reference in its entirety.

### Background of Invention

[Para 2] An arrangement of the nature of the present disclosure is found in US 5,546,705, which is hereby expressly incorporated herein by reference for purposes of disclosure as part of the present written description.

[Para 3] Vehicular mountable cargo containers, of the variety commonly referred to as cargo boxes, are well known. As in the instant depicted in US 5,546,705, one type of such a carrier is roof mounted, and among those, there is a particular type that the present applicant refers to as being a Dual Sided Opening cargo box.

[Para 4] As described in US 5,546,705, a dual-force strut (or struts) can be used between the two halves of the container that provide a opening spring force when in a range of motion approaching the open configuration and an opposite direction closing spring force when in a range of motion approaching the closed configuration. A distinct transition regarding the direction of the force (from urged extension to urged retraction) occurs therebetween. In the instance of the strut's closing force, that, together with the weight of the top can, instead of assisting the operator, cause the top to undesirably slam shut.

[Para 5] In another aspect, when two struts are used, one at each end of the cargo box as shown in US 5,546,705, the relatively strong forces imposed by the struts can result in the two ends of the box both opening and closing in an

imbalanced manner (one gets ahead of the other in the direction that is being urged by the operator, or the two struts apply different direction urgings with respect to each other at the same time; that is, one strut is urging closure while the other strut is urging opening. This detrimentally results in a twisting or torquing of the usually semi-flexible box-top which presents as misbehavior or mal-performance of the product to the operator.

## Summary of the Invention

[Para 6] In at least one exemplary embodiment, the present invention takes the form of a method for providing and controlling operation of a dual sided opening roof mount cargo box that is designed to be installed upon a carrying vehicle such as a automobile. It should be appreciated, however, that the cargo box does not necessarily have to be actually installed upon a vehicle to constitute an example of this embodiment of the invention. The method includes providing a dual sided opening roof mount cargo box having a lid portion releasably hinge-connected at two lateral sides to a bottom portion of the cargo box. With two releasable hinge connections, one on each long-side of the box, by keeping one side hinge-connected and the opposite side's hinge released, the box can be opened at the released side by pivoting the lid portion about the still fastened, opposite hinge connection. This arrangement is known as being dual sided opening in the cargo box carrier technologies (for example, see US 5,546,705 referred to hereinabove), and with respect to the present invention, is recited as being for accommodating alternate pivotation at each of the two lateral sides between open and closed configurations of the cargo box.

[Para 7] In keeping therewith, the bottom portion is adapted to be mounted to the carrying vehicle. Such adaptation can take any of a number of forms and includes tightenable assemblies that inter-connect the box to crossbar members of vehicular carried rack systems. The lid portion is exemplarily manufactured from a semi-flexible material sufficiently pliable to permit two opposite end regions thereof to be at different relative distances from the bottom portion of the cargo box during transition between the open and

closed configurations. With respect to the background description provided hereinabove, this characteristic can be likened to a twisting or torquing of the lid which users typically wish to avoid, but because of the large size of the lid, and the usual need to construct the same from relatively inexpensive and thin plastic, the construction of the lid itself usually cannot be, or at least will not be, sufficiently fortified to prevent such twist.

[Para 8] For these reasons, this present embodiment of the invention employs uniquely configured and operable support(s) interposed between the lid and bottom portions of the box. This support is established by providing a pair of spring-biased struts, each operatively interposed between the lid portion and the bottom portion of the cargo box. One each of the pair of spring-biased struts is located at the two opposite end regions of the cargo box.

[Para 9] When an operator opens the box, the support arrangement imposes an expansively directed force on the lid portion, utilizing the pair of spring-biased struts, across a substantial entirety of travel of the lid portion during operator induced movement from the closed configuration to the open configuration of the box, and thereby assisting the operator to smoothly open the cargo box.

[Para 10] In a further development of this exemplary embodiment of the invention, the expansively directed force is controlled, through configuration of the pair of spring-biased struts, to have a magnitude that substantially balances a weight of the lid portion across a range of motion, T, of the lid portion when operating in proximity of the closed configuration. That is to say, as the lid portion is either departing the bottom portion moving toward the open configuration, or is approaching the bottom portion moving toward the closed configuration, the supports are configured so that the force imposed between the lid and bottom portions of the box in the range of motion occurring when the two box halves are proximate one another is substantially equal to the force stemming from the weight of the lid which tends to move the lid to the fully closed position unless opposed; e.g. the struts.

**[Para 11]** In a complimentary, but different embodiment, the present invention takes the form of a spring-biased strut for a vehicular mountable cargo container or box having a top portion hinge-connected for pivotation relative to a bottom portion of the cargo container. The strut includes two arms operatively connected for pivotation relative to one another through a delimited range of motion. In the illustrated embodiment, such delimitation is affected using stops that impede further progressive motion of one of the arms relative to the other.

**[Para 12]** A biasing spring is operatively interposed between the two arms, and the biasing spring is configured to be operationally influential on the two arms during transitions between first and second strut orientations that correspond to open and closed configurations of an incorporating vehicular mountable cargo container.

**[Para 13]** The two arms are adapted so that one each is connectable to the top and bottom portions of the vehicular mountable cargo container thereby enabling the strut to deliver an assisting force for urging the cargo container into the open configuration. The two arms are configured relative to one another, and relative to the biasing spring so that across a substantial entirety of the delimited range of relative motion between the two arms, and which corresponds to a substantial entirety of relative motion between the top and bottom portions of the cargo container when transitioning between the open and closed configurations, the assisting force imparted to the cargo container acts in one rotational direction urging the vehicular mountable cargo container toward the open configuration.

**[Para 14]** In still a further complementary embodiment, the invention takes the form of a vehicular mountable cargo container having a top portion hinge-connected for pivotation relative to a bottom portion of the cargo container between open and closed configurations. A pair of spring-biased struts are included, each operatively interposed between the top and bottom portions of the vehicular mountable cargo container, and one each of the pair of spring-biased struts located at opposed end regions of the cargo container. Each of the pair of spring-biased struts is configured to exclusively deliver an assisting

expansion force between the top and bottom portions of the cargo container for urging the container toward the open configuration. That is to say, the struts do not impose or exert a force between the top and bottom portions tending to close the cargo box.

[Para 15] In at least one development of this embodiment of the invention, the force being purely directed in an opening direction stems from the fact that each of the pair of spring-biased struts is configured to avoid or prevent the delivery or imposition of a closing-assist force between the top and bottom portions of the cargo container that would urge the container toward the closed configuration. In a further aspect of this embodiment of the invention, each of the pair of spring-biased struts is configured to perform in substantial unison, one with the other, thereby urging maintenance of a parallel orientation of the top portion, relative to the bottom portion of the cargo container when transitioned by an operator between the open and closed configurations.

[Para 16] By way of example, this tendency to urge maintenance of the lid portion in an even or horizontal orientation during transition between the open and closed configurations of the box is fostered by the fact that the magnitude of the opening force imparted by the struts is substantially equal to the weight of the lid that is borne thereby, as well of the fact that the strut does not transition between forces that tend to urge the box halves apart toward the open configuration and forces that tend to urge the box halves together toward the closed configuration as exemplified in the disclosure of US 5,546,705. As intimated above, if the two distantly spaced apart struts located at opposite ends of the cargo box were to be permitted to assume configurations in which oppositely directed forces are imposed between the box halves at the two ends of the box, the undesirable torquing or twisting of the lid that has been described relative to known box configurations would likely occur; and it is the avoidance of such misbehavior or mal-performance of the box that the present invention is purposed.

## Brief Summary of the Drawings

[Para 17] Fig. 1 is a perspective view of a carrying vehicle with a dual sided opening roof mount cargo box installed thereupon, showing one support strut and phantom at a front end thereof;

[Para 18] Fig. 2 is a perspective end view of a closed cargo box showing an exemplary support strut in phantom;

[Para 19] Fig. 3 is a perspective end view of a cargo box open on the right side and substantially revealing an exemplary support strut, as well as an illustration of the cargo box open on the left side, depicted in dashed lines;

[Para 20] Fig. 4 is a perspective end view of a closed cargo box showing an exemplary support strut in phantom in both open and close configurations, together with an open configuration of the box shown in phantom, the open (O) and closed (C) configurations of the box are indicated, as well as a transitional (T) range of travel, together with an upward (U) range of travel;

[Para 21] Fig. 5 is a schematic side elevational view of a support strut in a first orientation corresponding to an open configuration of the cargo box;

[Para 22] Fig. 6 is a schematic side elevational view of a support strut in a transitional orientation corresponding to a position between the open and closed configuration of the cargo box;

[Para 23] Fig. 7 is a schematic side elevational view of a support strut in a second orientation corresponding to a closed configuration of the cargo box; and

[Para 24] Fig. 8 is a detailed schematic side elevational view of the cooperating portions and elements between the two arms of the support strut substantially as depicted in Fig. 6.

## Detailed Description

[Para 25] Preferred embodiment(s) of the disclosed invention(s) are illustrated and described in the accompanying drawings. Referring to Fig. 1, a perspective view of vehicular mounted cargo container is illustrated demonstrating in phantom, exemplary placement of one of two struts

configured according to the teachings of the present invention(s). In Fig. 2, an end perspective view of the vehicular mounted cargo container of Fig. 1 is shown in a closed configuration. An end perspective view of the vehicular mounted cargo container of Figs. 1 and 2 is shown in Fig. 3 illustrating the dual sided opening feature wherein the right side is open and the top of the container is shown solidly, while the left side is shown in an open configuration with the top of the container depicted in phantom.

[Para 26] Fig. 4 depicts the vehicular mounted cargo container of Figs. 1, 2 and 3 hinged at the left side and showing a closed configuration with solid lines and an open configuration shown in phantom. Therein, the open configuration of the container is designated with the letter O and the closed configuration is designated with the letter C. A range of motion over which an upward urging force is imposed by the strut(s) on the container top is designated with the letter U and a range of motion over which a transitional urging force is imposed by the struts on the container top is designated with the letter T. In the "T" range of possible configurations of the container, a force of substantially constant magnitude is preferably exerted by the strut(s) on the container, and the magnitude is preferably insufficient to independently move the container top. In a particularly preferred embodiment, an expansion force is imposed on the container by the strut(s) that is sufficient to assist an operator in opening the top, but not so great as to significantly oppose closing by the operator. Fig. 5 illustrates a first strut orientation corresponding to an open configuration of the container. Fig. 6 illustrates an intermediate strut orientation corresponding to a transitional configuration of the container. Fig. 7 illustrates a second strut orientation corresponding to a closed configuration of the container. Fig. 8 is a detailed view of the cooperative region between the arms (60, 70). A supporting cam surface is defined between the O and C delimiters described hereinabove.

[Para 27] Referring to the invention more generally, Fig. 1 depicts a vehicular mountable cargo container (10) comprising a top portion (30) of the vehicular mountable cargo container (10) hinge-connected for pivotation relative to a bottom portion (32) of the cargo container between open (O) and closed (C)

configurations. A pair of spring-biased struts (50) are also provided, each operatively interposed between the top (30) and bottom portions (32) of the vehicular mountable cargo container. One each of the pair of spring-biased struts (50) is located at opposed end regions of the cargo container. Each of the pair of spring-biased struts (50) is configured to exclusively deliver an assisting expansion force between the top (30) and bottom portions (32) of the cargo container (10) for urging the container toward the open (O) configuration.

[Para 28] Each of the pair of spring-biased struts (50) is configured to at least avoid, and preferably to deliver a closing-assist force between the top (30) and bottom (32) portions of the cargo container (10) that urges the container toward the closed (C) configuration.

[Para 29] Still further, each of the pair of spring-biased struts (50) is configured to perform in substantial unison, one with the other, thereby urging maintenance of a parallel orientation of the top portion (30), relative to the bottom portion (32) of the cargo container (10) when transitioned by an operator between the open (O) and closed (C) configurations.

Complementarily, the substantially unified movement of the top portion or lid (3) substantially prevents the inducement of torque or twist in the top portion (30) relative to the bottom portion (32) of the cargo container (10) when transitioned by an operator between the open (O) and closed (C) configurations.

[Para 30] A cam surface is provided at one of the two arms and establishes a surficial interaction between the two arms during transitions between the first and second strut orientations. A force communication point ( $C_P$ ) is defined by a point of support of the non-cam surface including arm on the cam-including arm at the cam surface, and which moves across the cam surface as the two arms pivot relative to one another between the first and second strut orientations. During such full range of motion, however, the force communication point ( $C_P$ ) remains exclusively on one side of a line oriented parallel to a direction of the operationally effective force imposed by the biasing spring between the two arms and intersecting a pivot connection



between the two arms. In a preferred embodiment, this line is also oriented substantially parallel to a longitudinal axis ( $V_L$ ) of the non-cam-including arm.

24. In a related aspect, the non-cam-including arm comprises an arm body housing a spring biased slider therein, the slider being configured for relative reciprocation within the arm body and the slider presenting a reception surface for establishing a sliding point of contact with the cam surface of the cam-including arm; the sliding point of contact coinciding with the force communication point ( $C_P$ ).

[Para 31] In another embodiment, the invention takes the form of a strut that includes two arms (60, 70) operatively connected for pivotation relative to one another through a delimited range of motion. A biasing spring (80) is operatively interposed between the two arms, and with the biasing spring being configured to be operationally influential on the two arms during transitions between first and second strut orientations that correspond to open and closed configurations of an incorporating vehicular mountable cargo container. The two arms are one each connectable to the top and bottom portions of the vehicular mountable cargo container thereby enabling the strut to deliver an assisting force for urging the cargo container into the open configuration. Pivot connections (93, 96) serve to connect the strut (50) to the top (30) and bottom (32) halves of the container. The two arms are configured relative to one another and the biasing spring so that across a substantial entirety of the delimited range of relative motion between the two arms, and which corresponds to a substantial entirety of relative motion between the top and bottom portions of the cargo container when transitioning between the open and closed configurations, the assisting force imparted to the cargo container acts in one rotational direction urging the vehicular mountable cargo container toward the open configuration.

[Para 32] Delimiters (46, 47) are provided and configured to limit the range of relative motion between the two arms so that throughout the entire range of transitional motion of the strut between the first and second strut orientations, the operationally effective force imposed by the biasing spring between the two arms exclusively urges either one of clockwise or counter clockwise

pivotation of the cam surface including arm relative to the non-cam surface including arm. In this regard, the arms (60, 70) are pivotally connected at the connection (90), and counter clock-wise motion of the arm (60) relative to the arm (70) is delimited by stop (46), while clock-wise motion of the arm (60) relative to the arm (70) is delimited by stop (47). The cam surface and the biasing spring, together with a pivot connection between the two arms establish a capability for an over-center strut orientation at which the direction of the operationally effective force imposed by the biasing spring between the two arms would change between exclusively urging the one of clockwise and counter clockwise pivotation of the cam surface including arm relative to the non-cam surface including arm, but for the delimiters.

[Para 33] Referring to Figs. 5–8, in the illustrated embodiment the non-cam surface including arm houses a spring-biased (see spring 80), rising and falling slide, carrier or platform (40) that is depicted as being operatively interposed between the two arms (60, 70). A ridge (42) on the arm 70 within an interior space (74) thereof, and a groove (44) on the translating platform (40) exemplarily cooperate as guides for reciprocating motion of the platform within the non-cam surface including arm.

[Para 34] In at least one embodiment, the operationally effective force imposed by the biasing spring between the two arms is constituted as a summation of a plurality of vector forces imposed by the biasing spring between the two arms.

[Para 35] The invention may be alternatively characterized as a method for providing and controlling operation of a dual sided opening roof mount cargo box (10) for a carrying vehicle. The method includes providing a dual sided opening roof mount cargo box (10) having a lid portion (30) releasably hinge-connected at two lateral sides to a bottom portion (32) of the cargo box (10) for alternate pivotation at each of the two lateral sides between open and closed configurations. The bottom portion (32) is adapted to be mounted to a carrying vehicle and the lid portion (30) is manufactured from a semi-flexible material sufficiently pliable to permit two opposite end regions thereof to be at different relative distances from the bottom portion (32) of the cargo box (1)

during transition between the open and closed configurations. A pair of spring-biased struts (50) is provided, each operatively interposed between the lid portion (30) and the bottom portion (32) of the cargo box (10), and one each of the pair of spring-biased struts (50) being located at the two opposite end regions of the cargo box. An expansively directed force is exerted on the lid portion (30), utilizing the pair of spring-biased struts (50), across a substantial entirety of travel of the lid portion (30) during operator induced movement from the closed configuration to the open configuration and thereby assisting the operator to smoothly open the cargo box (10).

[Para 36] The expansively directed force is controlled through configuration of the pair of spring-biased struts (50) to have a magnitude that substantially balances a weight of the lid portion (30) across a range of motion (T) of the lid portion (30) when operating in proximity of the closed configuration. This facilitates an operator's even lifting of the lid portion (30) across the range of motion (T) thereby avoiding strut-induced twist in the lid portion (30). Still further, the expansively directed force is controlled to have a magnitude that increases compared to that imposed across the range of motion (T) of the lid portion (30) when operating in proximity of the open configuration (U). Further yet, the expansively directed force is controlled, through configuration of the pair of spring-biased struts (50), to have a substantially zero magnitude when the lid portion (30) is in the closed configuration. This feature avoids fatigue being induced at the strut-engaging portions of the lid portion (30) and bottom portion (32) of the cargo box (10).